

REMARKS

Claims 9-13 and newly added claims 20-26 are the claims pending in the application.

Claim 10 stands rejected upon informalities. Claims 9-13 stand rejected under the judicially created doctrine of obviousness-type double patenting and on prior art grounds. In addition, the specification is objected to. Applicants respectfully traverse these objections/rejections based on the following discussion.

I. The 35 U.S.C. §112, Second Paragraph, Rejection and Specification Objection

Claim 10 stands rejected under 35 U.S.C. Section 112, second paragraph. Claim 10 and paragraph [0067] of the Specification are herein amended, as recommended by the Examiner, to reflect the dopant concentration as approximately 1×10^{20} per cm^3 to 1×10^{21} per cm^3 .

II. Double Patenting Rejection

Claims 9-13 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of Lanzerotti, et al. (U.S. Patent No. 6,670,654), hereinafter referred to as Lanzerotti '654. These rejections are traversed as explained below. Specifically, 35 U.S.C. Section 121 regarding divisional applications, states as follows:

... A patent issuing on an application with respect to which a requirement for restriction under this section has been made, or on an application filed as a result of such a
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requirement, shall not be used as a reference either in the Patent and Trademark Office or in the courts against a divisional application or against the original application or any patent issued on either of them, if the divisional application is filed before the issuance of the patent on the other application. ...

Lanzerotti '654 issued on December 30, 2003 from U.S. Patent Application No.

09/683,498 which is the parent application for the present application (U.S. Patent Application No. 10/660,048). Claims 9-13 of the present application are the same as claims 9-13 of Lanzerotti '654 and were filed as a divisional application on September 23, 2003 (before the December 30, 2003 issue date) in response to a restriction requirement (see attached Office Action dated on September 10, 2002). Thus, pursuant to 35 U.S.C. Section 121 Lanzerotti '654 shall not be referenced by the Patent and Trademark Office in a double patenting rejection. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw this rejection. However, if necessary, once a notice of allowance is issued on the Claims 9-13, the applicant will file a terminal disclaimer.

III. The 35 U.S.C. 102(b or e) or, Alternatively, 35 U.S.C. 103(a) Rejection.

Claims 9-13 stand rejected under 35 U.S.C. Section 102(b or e) as being anticipated by or, in the alternative under 35 U.S.C. Section 103(a) as obvious over Lippert, et al. (U.S. Patent No. 6,750,484), hereinafter referred to as Lippert. Additionally, Claim 11 stands rejected under 35 U.S.C. Section 103(a) as being unpatentable over Lippert, in view of Sakamoto (U.S. Patent No. 5,750,443), herein after referred to as Sakamoto, and Bisaro, et al. (U.S. Patent No.

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5,141,894), hereinafter referred to as Bisaro. Applicants respectfully traverse these rejections based on the following discussion.

In response to the rejections under 35 U.S.C. Sections 102 and 103 of claims 9-13, based on Lippert, the Applicants respectfully submit that the Lippert invention does not teach, suggest or make obvious the claimed semiconductor of claim 9. Specifically, Lippert does not disclose or make obvious a semiconductor having a "a doped region that comprises less than all of said semiconductor and comprises a dopant interacting with said carbon atoms". Nor does the Lippert invention disclose or make obvious that "carbon atoms limit outdiffusion of said dopant within said semiconductor to physically limit a size of said doped region" and that "said dopant is included in sufficient quantities to reduce a resistance of said semiconductor to less than approximately 4 Kohms/cm²". On the contrary Lippert describes a bipolar transistor in which carbon is used in the entire base of a SiGe transistor and simply prevents outdiffusion of the dopant (boron) from the base layer using carbon in order to allow the size of the base layer to be scaled (see Lippert Col. 2, lines 45-50, see Figure 3) or to allow the amount of dopant to be increased (abstract). Specifically, the following features of Lippert are distinguishable from the claimed invention: (1) a collector region 32 above a silicon wafer 32 (see Lippert Figure 3); (2) a base region 34/collector region 32 stack above a highly doped silicon substrate 31 (see Lippert Col. 4, lines 34-44 and Figure 3); and, (3) a base region 34 that is a single crystal silicon germanium carbon epitaxy doped with boron (see Lippert Col. 4, lines 34-44) and that has isolation structures which define its size (see Figure 3). Additionally, the Lippert transistor structure does not comprise local oxidation of silicon (LOCOS) isolation and does not comprise

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a base region with carbon over a shallow trench isolation structure.

The claimed invention includes a semiconductor layer for use with a bipolar transistor and, specifically, a semiconductor layer with reduced resistance (e.g., to less than approximately 4 Kohms/cm²) in order to control breakdown voltage and to improve electrostatic discharge protection (see paragraph [0034]). The reduced resistance within the semiconductor layer is achieved not by doping the entire semiconductor layer, but rather by providing a doped region within the semiconductor layer and limiting the size of the doped region in relation to the entire semiconductor by incorporating carbon atoms into the semiconductor layer. The dopant itself is also included in sufficient quantities such that the resistance of the semiconductor is reduced to less than approximately 4 Kohms/cm².

More particularly, the semiconductor layer of the claimed invention comprises both a polycrystalline semiconductor region 6 (e.g., a conductive amorphous polysilicon germanium carbon film) above a shallow trench isolation structure 7 and a single crystal semiconductor region 5 (e.g., single crystal silicon germanium carbon film) above a silicon collector region 15 (see paragraphs [0037] and [0070]). While silicon germanium carbon is given as an example of the semiconductor material which may be used for the semiconductor regions 5 and 6, any conventional semiconductor material doped with carbon may be used (see paragraph [0070]). Within the single crystal semiconductor region 5 and the polysilicon semiconductor region 6, the semiconductor also comprises a doped semiconductor region 8 (e.g., boron-doped region) above the silicon collector region 15 (see paragraph [0038] and Figure 12). The doped region 8 (e.g., boron-doped region) can be located immediately above a p+dopant implant 9 that is located

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within the collector region 15 adjacent to the trench 7 (see paragraphs [0037] and [0044] and Figure 12). This doped region 8 is located within a central portion of the semiconductor and is formed by using a masking process prior to implanting the dopant (a process not disclosed in Lippert). The carbon in the semiconductor regions 5, 6 limits diffusion of the dopant outside the small doped region 8 and helps keep the boron in a tight physical distribution within semiconductor regions 5, 6 (see paragraphs [0042] and [0044]). Limiting the size of the doped region within the semiconductor regions 5, 6 provides improved base resistance control (see paragraph [0047]) allowing for increased speed and breakdown voltages (which decrease electrostatic discharge (ESD)) (see paragraph [0034]). This translates into less variation in the current-to-failure, voltage-to failure, and power-to-failure levels. Additionally, because boron can be limited to a smaller area within the semiconductor layer, boron concentration in the smaller area can be increased while still maintaining good device and radio frequency characteristics (see paragraph [0046]). Furthermore, keeping the boron in a small area allows the transistor structure to be scaled to a smaller size (see paragraph [0034]). The carbon also reduces strain within the entire epitaxial film 5, 6 and, thereby, avoids misfit dislocations (see paragraph [0043]).

Claim 9 is amended herein to reflect that the dopants of the semiconductor are contained "within a doped region that comprises less than all of said semiconductor" itself and that the carbon atoms "limit outdiffusion of said dopant to physically limit a size of said doped region within said semiconductor". The Applicant submits that Claim 9 is neither anticipated by Lippert under 35 U.S.C. 102 (b or e), nor obvious over Lippert under 35 U.S.C. 103(a).

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Specifically, Lippert does not teach each element of the claim, as required by MPEP Section 2131, in that an entire semiconductor base region of Lippert is doped with boron, not simply a smaller area of a semiconductor layer as in the claimed invention. Additionally, the Office Action indicates that resistance of less than $4K \text{ ohms/cm}^2$ would be inherent or otherwise obvious given the teachings of Lippert; however, the Applicant disagrees in that resistance is a not a function of the concentrations of boron and carbon alone, but also of the size of the semiconductor within which the smaller doped (diffusion) region is located (see paragraph [0012]). Therefore, the Applicant submits that Claim 9 is patently distinct over Lippert and is in condition of allowance. Further dependent claims 10-13 are similarly patentable, not only by virtue of their dependency from a patentable dependent claim, but also by virtue of the additional features of the invention that they define.

III. Formal Matters and Conclusion

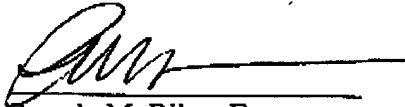
Regarding the objections to the specification, the specification has been amended, above, to overcome these objections. In view of the prior restriction requirement, the Examiner is respectfully requested to reconsider and withdraw the double patenting rejection. In view of the foregoing, Applicants submit that claims 9-13 and newly added claims 20-26, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. Moreover, no new matter is added and all features recited in newly added claims 20-26 are fully supported by the specification as filed. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

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Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0456.

Respectfully submitted,

Dated: 5/31/05


Pamela M. Riley, Esq.
Registration No. 40,146

McGinn & Gibb, PLLC
2568-A Riva Road, Suite 304
Annapolis, MD 21401
(410) 573-0227
Customer Number: 29154

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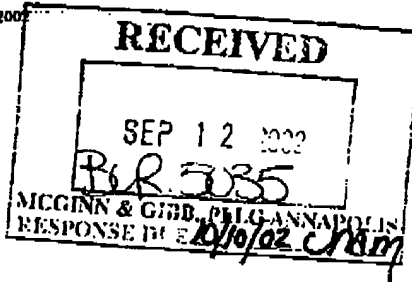


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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/683,498	01/09/2002	Louis D. Lanzerotti	BUR920010146	6662

29154 7590 09/10/2002
FREDERICK W. GIBB, III
MCGINN & GIBB, PLLC
2568-A RIVA ROAD
SUITE 304
ANNAPOLIS, MD 21401

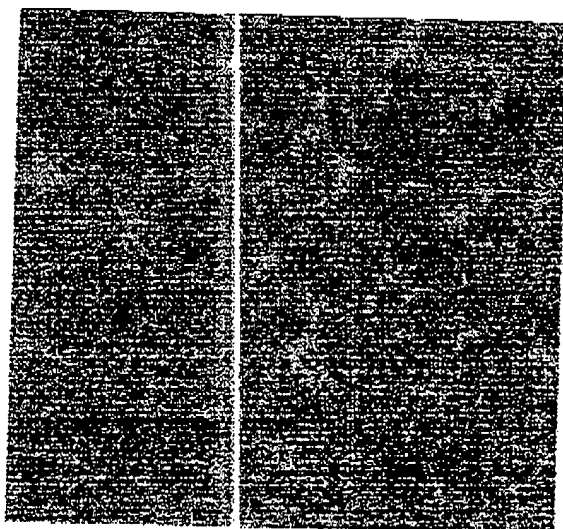


EXAMINER
OWENS, BETH E

ART UNIT PAPER NUMBER
2824

DATE MAILED: 09/10/2002

Please find below and/or attached an Office communication concerning this application or proceeding.



BEST AVAILABLE COPY

Office Action Summary	Application No.		Applicant(s)	
	08/683,498		LANZEROTTI ET AL.	
	Examiner		Art Unit	
	Beth E. Owens		2824	

- The MAILING DATE of this communication appears on the cover sheet with the correspondence address -

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.135(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☐ Claim(s) ____ is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☒ Claim(s) 1-19 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s) ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-848) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____. | 6) <input type="checkbox"/> Other: |

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Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-8, drawn to the device, classified in class 257, subclass 183+.
- II. Claims 9-13, drawn to the device, classified in class 257, subclass 9+.
- III. Claims 14-19, drawn to the method of manufacturing, classified in class 438, subclass 312.

The inventions are distinct, each from the other because of the following reasons:

Inventions Groups I/II and Group III are related as the process of making and the product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process [MPEP §806.05 (f)]. For example, it is possible the semiconductor containing carbon and dopant may be formed in a non-epitaxial fashion. Because these inventions are distinct for the reason given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

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Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Beth E. Owens, Ph.D. whose telephone number is 703.305.2369.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms, can be reached on 703.308.2816. The fax phone numbers for the organization where this application or proceeding is assigned are 703.746.4093 for regular communications and 703.305.3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703.308.0956.

09.07.02 BEO



RICHARD ELMS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800